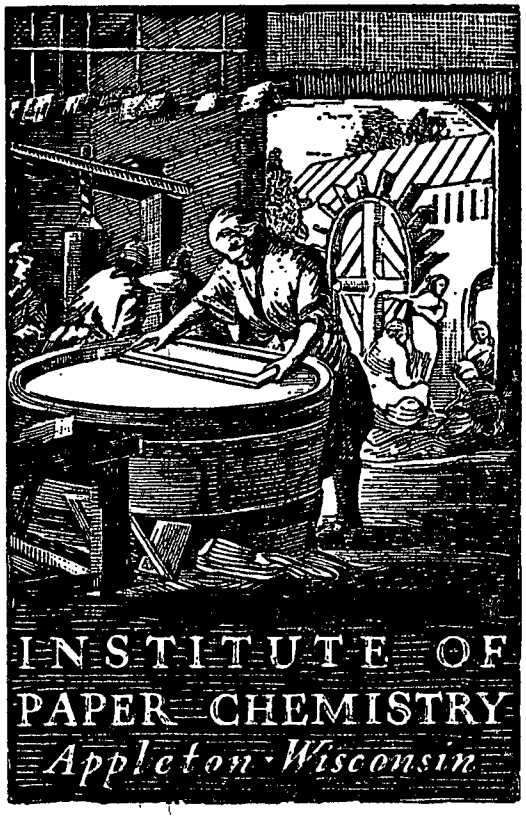

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

Project 1108-17

Progress Report Thirty-nine

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

February 1, 1959

SCRAMBLED CODE LETTERS FOR PROGRESS REPORT 39, PROJECT 1108-17
CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

Company - Mill	Machine No.	Code Letter
The Chesapeake Corporation - West Point	1	--
Continental Can Company, Inc. - Hopewell	1	G
Gaylord Container Corporation - Bogalusa	4	--
International Paper Company		
Bastrop	1	N
Bastrop	2	--
Georgetown	1	P
Georgetown	2	--
The Mead Corporation		
Sylva	1	B
Lynchburg	2	J
Harriman	1	R
Muskingum Fibre Products Company - Coshocton	1	Q
North Carolina Pulp Company - Plymouth	3	D
Olin Mathieson Chemical Corporation		
Monroe	1	--
Monroe	2	O
Owens-Illinois Glass Company		
Tomahawk	1	E
Tomahawk	2	L
Tomahawk	3	F
Big Island	1	A
Big Island	2	C
St. Joe Paper Company - Port St. Joe	1	H
Union Bag-Camp Paper Corporation - Savannah	2	M
West Virginia Pulp and Paper Company		
Covington	6	I
Covington	7	--
Hinde and Dauch of Canada - Trenton	1	--
Charleston		K

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

Project 1108-17

Progress Report Thirty-Nine

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

February 1, 1959

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THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONTINUOUS EVALUATION OF CORRUGATING MEDIUM

PURPOSE OF THIS STUDY

The purpose of this study is to provide a continuous evaluation of the quality and runability of corrugating medium produced by members of the Fourdrinier Kraft Board Institute. The study, as it progresses, is accumulating a backlog of data and experience which provides two important benefits. First, it enables each participant to evaluate his position in relation to the rest of the industry. Second, it provides background information essential for the judicious interpretation of any proposed specifications on corrugating medium (on either a company or industry basis).

PROCEDURE FOR PARTICIPATING

The procedure for participating in this study involves the submission of two rolls of corrugating medium per week from each machine to The Institute of Paper Chemistry. These rolls are taken from regular production runs on <u>different</u> days. Each roll is 10 to 12 inches wide and contains approximately 5,000 lineal feet of medium (approximately 30 inches in diameter). When received by the Institute, each roll is assigned a code letter and number. The rolls are numbered in the sequence in which they are received. Code letters are assigned on the basis of machines, and a given machine is assigned a different code letter each month in order to mask the identity of the mills. For purposes of reference, an outline of this program which describes the necessary instructions for sampling was appended to Progress Report One in this series.

PRESENTATION AND DISCUSSION OF TEST RESULTS OBTAINED AT THE INSTITUTE OF PAPER CHEMISTRY

During the month of January, seventy sample lots of corrugating medium were selected from the production of eighteen machines and submitted to The Institute of Paper Chemistry for evaluation. A tabulation of the number of rolls submitted from each machine is given in Table I.

Each sample of corrugating medium was evaluated for basis weight, caliper, Concora flat crush, H. and D. flat crush (single-faced board), and runability. Runability was measured by corrugating each roll under standardized conditions on the Institute's corrugator into A-flute board at 600 feet per minute with minimum tension. If unsatisfactory runability occurred at this speed, the corrugator was slowed down in increments of 25 f.p.m. until satisfactory runability was obtained (no ruptured flutes). If the medium fabricated satisfactorily at 600 f.p.m. with minimum tension, further runs were made at higher tensions to determine when cracking occurred. The higher tensions used were 0.5 lb. per inch, 1.0 lb. per inch, and 1.5 lb. per inch. Maximum speed at minimum tension was also determined, the greatest speed being 1000 f.p.m.

Flat crush was determined on the board obtained at a speed of 600 f.p.m. with minimum tension. In addition to information about quality, these results will provide data which may be useful in studying the relationship between Concora flat crush and combined board flat crush for each participant's medium.

TABLE I

NUMBER OF ROLLS OF CORRUGATING MEDIUM SUBMITTED

FOR EVALUATION FROM EACH MACHINE

Machine Code	Number of Rolls
A	6
B	2
C	6
D	1
E	1
F	2
G	3
H	4
I	9
J	2
K	2
L	2
M	7
N	7
O	2
P	8
Q	2
R	4
Total	70

As requested by members of the F.K.B.I., the Concora medium test results are calculated on the basis of pounds of load per unit area rather than on the basis of the formula suggested by the Concora manufacturer and are reported as Concora flat crush test results. In Progress Reports One and Two, the Concora medium test results were reported on the basis of the formula suggested by the Concora manufacturer.

The average test results obtained on the samples of corrugating medium submitted by each participant (current machine averages) are shown in Table II and graphically presented in Figures 1 to 4. In addition to a comparison of the test data obtained for the various machines, Table II also presents the current F.K.I. averages, cumulative F.K.I. averages, and the F.K.I. indexes. The current F.K.I. average is the average of test results for all machines participating in the study during the current month. The cumulative F.K.I. average is based on the results for the previous twelve-month period excluding the result for the current period. The F.K.I. index is obtained as follows:

$$\frac{\text{current F.K.I. average}}{\text{cumulative F.K.I. average}} \times 100 = \text{F.K.I. index (\%)}$$

The F.K.I. index provides a ready means of comparing the current quality with previous results. An index greater than 100% indicates that current quality is higher than the average result for the previous twelve periods; an index below 100% indicates that current quality is lower than the average result for the previous twelve periods.

TABLE II

SUMMARY OF CURRENT MACHINE AVERAGES
January, 1959

Machine Code	Basis Weight, lb.	Caliper, points	Concora Flat Crush, p.s.i.	Single-Face Flat Crush, p.s.i.
A	27.3	9.7	36.5	33.2
B	28.0	11.4	33.6	32.3
C	26.8	9.8	37.6	32.5
D	26.7	10.2	36.6	35.8
E	26.3	10.3	33.4	32.0
F	26.3	10.2	34.7	32.3
G	26.8	9.8	37.7	33.4
H	28.3	9.8	36.0	30.7
I	26.2	10.7	35.1	30.6
J	27.2	10.5	34.6	28.6
K	27.5	10.5	36.4	30.6
L	26.8	10.9	35.0	33.8
M	27.4	9.6	38.6	33.7
N	26.7	11.0	40.2	35.3
O	28.5	10.0	39.2	30.6
P	27.9	10.5	41.6	36.2
Q	27.8	10.6	35.9	31.9
R	28.1	11.0	34.2	29.9
Current F.K.I. Average	27.3	10.4	36.5	32.4
Cumulative F.K.I. Average	27.1	10.3	35.4	33.6
F.K.I. Index, %	100.6	100.9	103.1	96.5

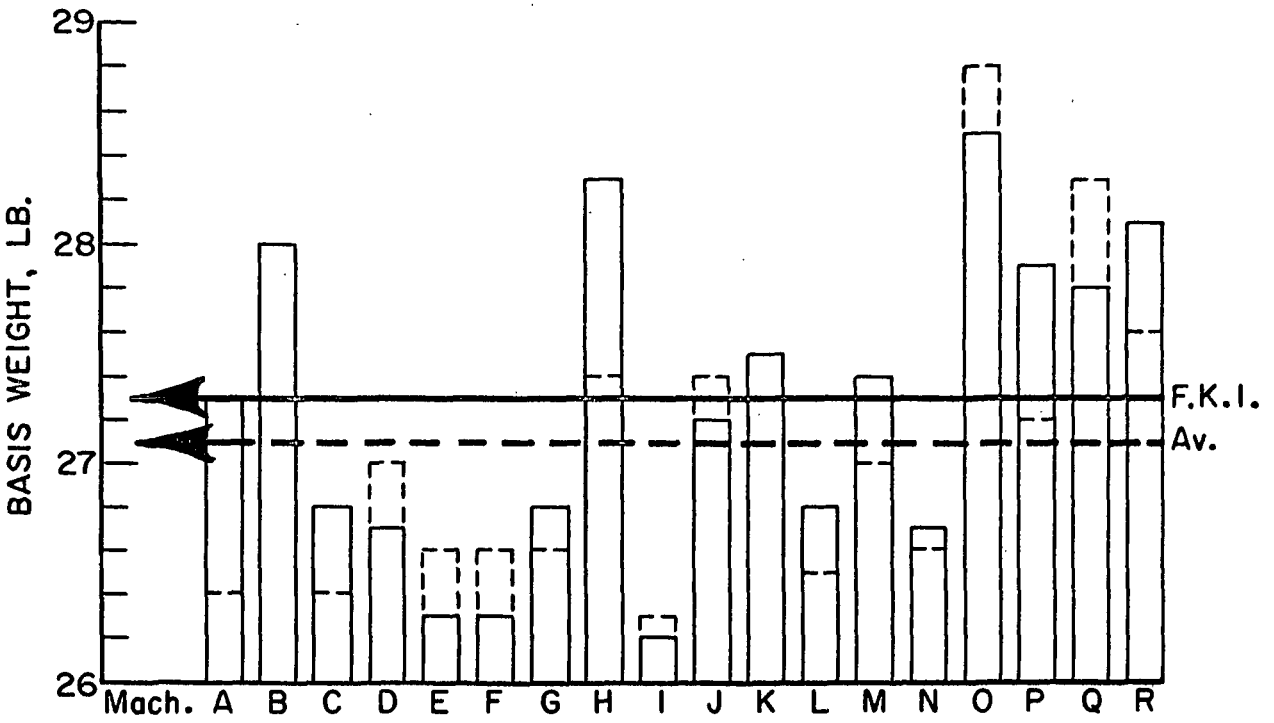

Figure 1

Comparison of Basis Weight Results for January, 1959

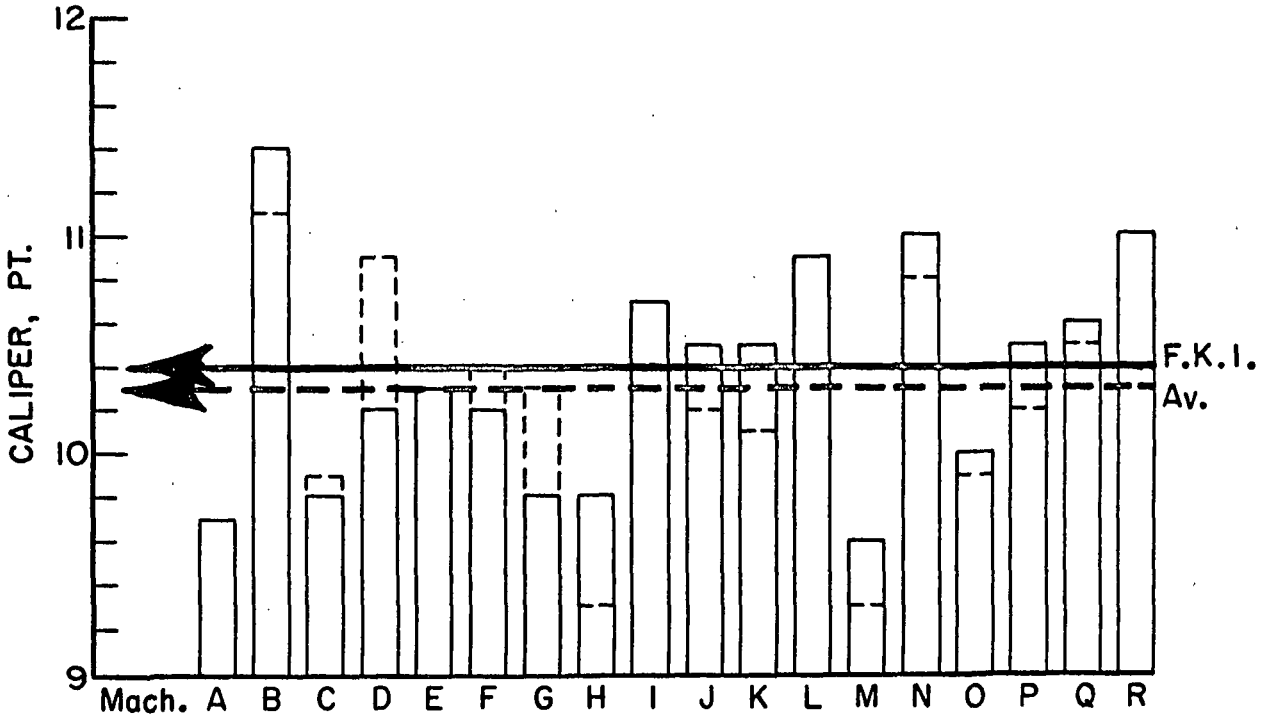

Figure 2

Comparison of Caliper Results for January, 1959

——— Current machine average

- - - - - Cumulative machine average

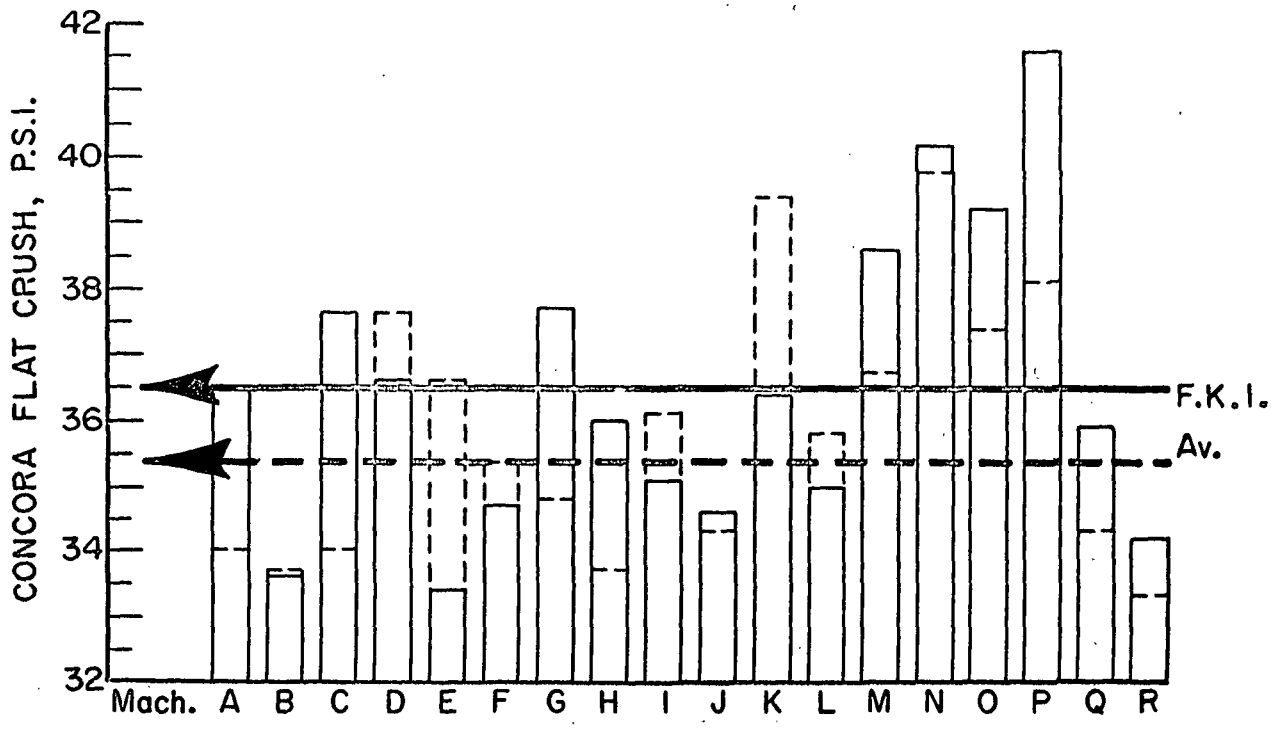

Figure 3

Comparison of Concora Flat Crush Results for January, 1959

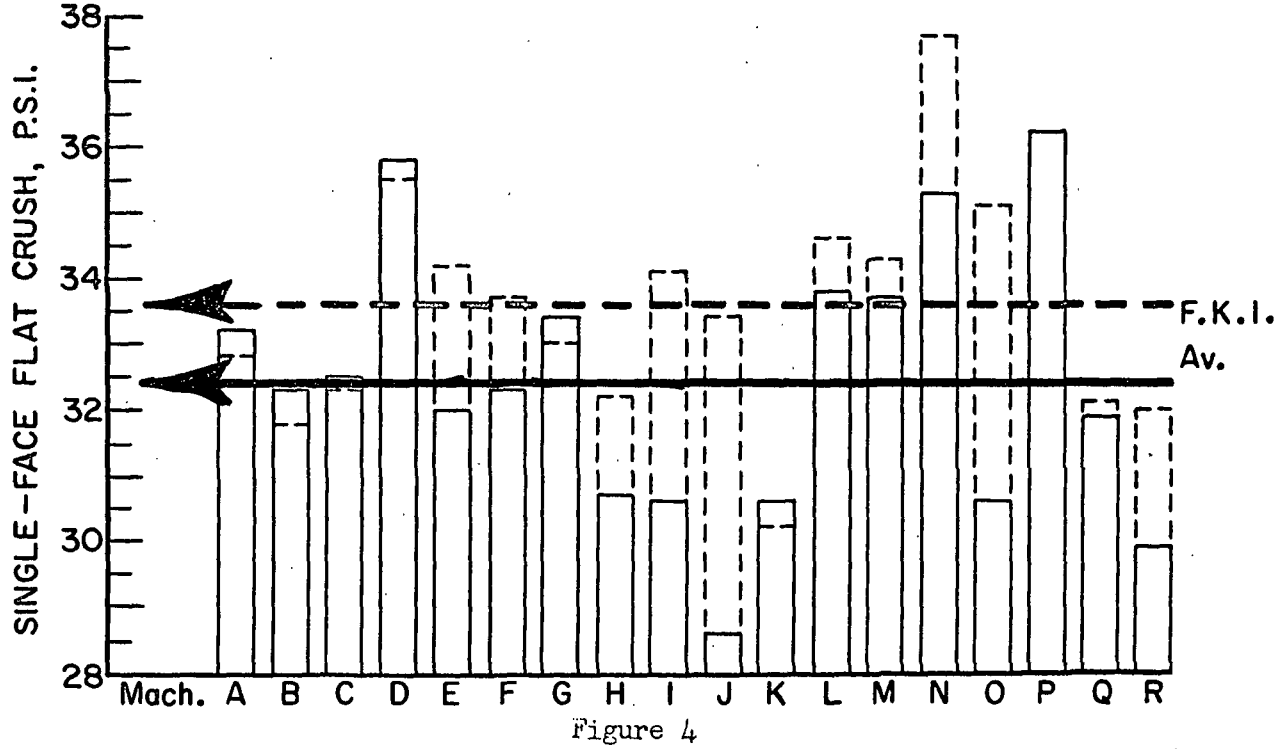

Figure 4

Comparison of Single-Face Flat Crush Results for January, 1959

——— Current machine average

- - - - - Cumulative machine average

In Table II the current machine averages for the month of January are summarized. It may be noted in Table II and Figure 1 that basis weight varied from a low of 26.2 lb. for Machine I to a high of 28.5 lb. for Machine O. The current F.K.I. average for basis weight was 27.3 lb. and the cumulative F.K.I. average was 27.1 lb. The fact that the current F.K.I. average was slightly higher than the cumulative F.K.I. average is reflected by the F.K.I. index of 100.6%. The average basis weight value for each of the eighteen machines was above the 26-lb. minimum requirement of Rule 41.

With regard to the caliper results for the current period, it may be seen in Table II and also in Figure 2 that the lowest average caliper data of 9.6 points was associated with Machine M and the highest average of 11.4 points with Machine B. The current F.K.I. average of 10.4 points was slightly higher than the cumulative F.K.I. average of 10.3 points, the F.K.I. index being 100.9%. The minimum caliper requirement of 9 points specified in Rule 41 was met by all participants.

The Concora flat crush averages for January are presented graphically in Figure 3 and in tabular form in Table II. An inspection of these results reveals that 41.6 p.s.i. was the highest average and 33.4 p.s.i. the lowest. Machine P was associated with the highest average and Machine E with the lowest. The current F.K.I. average of 36.5 p.s.i. was higher than the cumulative F.K.I. average of 35.4 p.s.i. The F.K.I. index was 103.1%.

The highest single-face flat crush average of 36.2 p.s.i. was obtained for Machine P and the lowest of 28.6 p.s.i. for Machine J. These data are shown in Table II and presented graphically in Figure 4. The

current F.K.I. average was 32.4 p.s.i., whereas the cumulative F.K.I. average was 33.6 p.s.i. The F.K.I. index was 96.5%.

For the current period, the current F.K.I. averages for basis weight, caliper, and Concora flat crush were higher than their cumulative F.K.I. averages, and the current F.K.I. average for single-face flat crush was lower than its cumulative F.K.I. average.

The test results obtained on the sample lots submitted from the production of each of the machines are shown in Tables III through XX for Machines A through R, respectively. The maximum, minimum, and average test results obtained on each sample lot are shown for all tests except basis weight for which only the average is shown; in addition, the over-all average result for all sample lots submitted from a given machine is shown for each test. The latter over-all averages are reported as "current machine averages." A cumulative machine average is also shown and is calculated by averaging the current machine averages for the previous twelve periods (excluding the current period). Also shown for each machine in Tables III to XX are the machine factor and machine index which are defined as follows:

$$\frac{\text{current machine average}}{\text{cumulative machine average}} \times 100 = \text{machine factor (\%)}$$

$$\frac{\text{current machine average}}{\text{cumulative F.K.I. average}} \times 100 = \text{machine index (\%)}$$

The machine factor and machine index provide a means for comparing the current machine average with either the previous results for that particular machine or with the cumulative results for all machines--i.e., the cumulative F.K.I. average.

TABLE III

SUMMARY OF TEST RESULTS FOR MACHINE A
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m. lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
A-1	12- 6-58	1- 7-59	479	27.6	10.2	9.8	10.0	40.2	36.0	37.9	34.0	32.6	33.2	1000	1-1/2
A-2	12- 8-58	1- 7-59	698	27.9	10.0	9.7	9.8	36.6	35.4	36.2	34.4	32.0	33.2	1000	1
A-3	12-17-58	1-19-59	1213	27.8	9.6	9.1	9.3	40.2	34.2	37.3	34.4	32.0	33.2	1000	1-1/2
A-4	12-18-58	1-19-59	1320	27.5	9.8	9.2	9.5	37.2	36.0	36.4	34.6	33.0	33.7	1000	1-1/2
A-5	12-22-58	1-19-59	1616	27.6	9.9	9.4	9.8	36.0	33.6	34.8	33.4	31.4	32.3	1000	1-1/2
A-6	1- 1-59	1-19-59	67	25.6	9.9	9.5	9.7	38.4	34.8	36.2	34.2	32.8	33.6	1000	1-1/2
Current Machine Average				27.3			9.7			36.5			33.2		
Cumulative Machine Average				26.4			9.7			34.0			32.8		
Machine Factor, %				103.4			100.0			107.2			101.2		
Machine Index, %				100.8			94.4			103.1			98.8		

TABLE IV

SUMMARY OF TEST RESULTS FOR MACHINE B
January, 1959

B-1	1- 8-59	1-13-59	111	28.4	11.8	11.2	11.5	37.2	33.0	34.8	33.8	31.2	32.7	1000	1-1/2
B-2	1 - 8-59	1-13-59	112	27.6	11.5	11.0	11.3	34.2	30.6	32.4	33.2	31.0	32.0	1000	1-1/2
Current Machine Average				28.0			11.4			33.6			32.3		
Cumulative Machine Average				28.0			11.1			33.7			31.8		
Machine Factor, %				100.0			102.4			99.7			101.7		
Machine Index, %				103.5			111.1			95.0			96.2		

TABLE V

SUMMARY OF TEST RESULTS FOR MACHINE C
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability Max. Speed at Min. Tension, f.p.m.	Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
C-1	12- 6-58	1- 7-59	494	27.0	10.0	9.5	9.8	40.8	35.4	37.3	35.0	33.6	34.3	1000	1-1/2
C-2	12- 9-58	1- 7-59	751	26.9	10.0	9.5	9.8	41.4	37.2	39.7	35.6	32.6	34.3	1000	1-1/2
C-3	12-15-58	1-19-59	1249	26.0	10.0	9.6	9.8	36.6	33.0	34.8	30.4	29.2	29.8	1000	1-1/2
C-4	12-20-58	1-19-59	1637	26.4	10.0	9.8	9.9	38.4	33.0	36.4	32.6	29.2	31.2	1000	1-1/2
C-5	12-30-58	1-19-59	2014	26.5	9.9	9.1	9.6	40.2	35.4	37.6	34.4	31.2	32.6	1000	1-1/2
C-6	12-31-58	1-19-59	2102	28.1	10.6	10.0	10.2	41.4	37.2	39.6	33.8	31.6	32.8	1000	1-1/2
Current Machine Average				26.8			9.8			37.6			32.5		
Cumulative Machine Average				26.4			9.9			34.0			32.3		
Machine Factor, %				101.6			99.7			110.3			100.7		
Machine Index, %				99.0			95.9			106.1			96.7		

TABLE VI

SUMMARY OF TEST RESULTS FOR MACHINE D
January, 1959

D-1	12- 9-58	1-19-59	184	26.7	10.7	9.8	10.2	39.0	33.6	36.6	38.0	34.4	35.8	700	1/2
Current Machine Average				26.7			10.2			36.6			35.8		
Cumulative Machine Average				27.0			10.9			37.6			35.5		
Machine Factor, %				98.9			93.1			97.5			100.9		
Machine Index, %				98.4			99.0			103.4			106.7		

TABLE VII

SUMMARY OF TEST RESULTS FOR MACHINE E
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
E-1	1- 9-59	1-15-59	25	26.3	10.7	10.0	10.3	34.8	32.4	33.4	33.0	30.0	32.0	800	1/2
Current Machine Average				26.3			10.3			33.4			32.0		
Cumulative Machine Average				26.6			10.3			36.6			34.2		
Machine Factor, %				98.6			100.0			91.1			93.8		
Machine Index, %				96.9			100.2			94.3			95.4		

TABLE VIII

SUMMARY OF TEST RESULTS FOR MACHINE F
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
F-1	12-23-58	1-15-59	29	26.1	10.5	9.7	10.2	36.0	33.0	34.4	33.4	31.4	32.1	575	--
F-2	1- 5-59	1-15-59	30	26.5	10.5	9.9	10.2	37.8	32.4	35.0	33.4	30.8	32.5	600	Min.
Current Machine Average				26.3			10.2			34.7			32.3		
Cumulative Machine Average				26.6			10.4			35.4			33.7		
Machine Factor, %				98.8			98.1			98.0			96.0		
Machine Index, %				97.1			99.5			98.2			96.2		

TABLE IX

SUMMARY OF TEST RESULTS FOR MACHINE G
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
G-1	1- 3-59	1-13-59	136	26.7	10.0	9.3	9.6	39.0	36.0	37.6	33.4	32.6	33.0	1000	1-1/2
G-2	1- 8-59	1-19-59	137	26.8	10.2	9.7	9.9	37.8	34.2	36.6	34.0	32.4	33.5	1000	1-1/2
G-3	1- 8-59	1-19-59	138	26.9	10.1	9.5	9.8	42.6	36.6	39.0	35.6	32.0	33.8	1000	1-1/2
Current Machine Average				26.8			9.8			37.7			33.4		
Cumulative Machine Average				26.6			10.3			34.8			33.0		
Machine Factor, %				100.8			94.9			108.4			101.2		
Machine Index, %				99.0			95.4			106.6			99.5		

TABLE X

SUMMARY OF TEST RESULTS FOR MACHINE H
January, 1959

H-1	12-20-58	1- 6-58	79	28.2	10.0	9.6	9.9	38.4	34.8	36.2	31.4	30.2	30.7	1000	1-1/2
H-2	12-20-58	1- 6-58	80	28.1	10.4	9.6	10.0	39.0	36.6	37.8	30.0	29.2	29.6	1000	1-1/2
H-3	12-30-58	1-13-59	81	28.2	10.7	9.3	10.0	39.6	30.6	34.2	32.4	30.4	31.3	1000	1-1/2
H-4	12-30-58	1-13-59	82	28.9	9.9	9.0	9.5	40.2	34.2	35.6	31.8	30.4	31.2	1000	1-1/2
Current Machine Average				28.3			9.8			36.0			30.7		
Cumulative Machine Average				27.4			9.3			33.7			32.2		
Machine Factor, %				103.2			105.7			106.7			95.2		
Machine Index, %				104.6			95.8			101.7			91.4		

TABLE XI

SUMMARY OF TEST RESULTS FOR MACHINE I
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
I-1	11- 6-58	1- 9-59	195	26.5	11.1	10.4	10.8	37.2	33.0	34.8	32.4	31.0	31.5	800	1/2
I-2	11-13-58	1- 9-59	197	26.1	11.0	10.5	10.8	37.8	34.2	35.8	31.8	29.0	30.2	800	1/2
I-3	11-20-58	1- 9-59	199	26.0	11.1	10.7	11.0	33.6	30.0	31.1	29.8	26.8	28.4	850	1/2
I-4	11-28-58	1- 9-59	202	26.7	11.0	10.3	10.6	39.6	33.6	37.1	34.2	30.6	32.2	800	1
I-5	12- 3-58	1- 9-59	203	26.4	11.0	10.5	10.8	36.0	31.8	34.4	31.0	29.4	30.0	750	1/2
I-6	12-19-58	1- 9-59	205	26.4	11.0	10.4	10.8	40.2	37.2	38.6	35.0	31.6	32.7	750	1/2
I-7	12-23-58	1- 9-59	206	26.1	11.2	10.3	10.8	34.2	30.0	32.2	32.4	27.0	29.1	800	1/2
I-8	12-30-58	1- 9-59	207	25.7	10.7	10.0	10.4	35.4	33.0	34.3	29.6	28.2	28.9	1000	1
I-9	1-13-59	1-19-59	209	26.3	10.8	10.3	10.6	39.0	36.0	37.3	34.6	31.4	32.8	1000	1-1/2
Current Machine Average				26.2			10.7			35.1			30.6		
Cumulative Machine Average				26.3			10.4			36.1			34.1		
Machine Factor, %				99.6			102.9			97.1			89.9		
Machine Index, %				96.9			104.5			99.1			91.3		

TABLE XII

SUMMARY OF TEST RESULTS FOR MACHINE J
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
J-1	12-31-58	1- 7-59	109	27.2	10.8	10.2	10.5	36.6	28.2	33.8	30.2	28.6	29.1	1000	1-1/2
J-2	12-31-58	1- 7-59	110	27.1	10.7	10.0	10.4	40.2	32.4	35.4	29.2	26.6	28.0	1000	1-1/2
Current Machine Average				27.2			10.5			34.6			28.6		
Cumulative Machine Average				27.4			10.2			34.3			33.4		
Machine Factor, %				99.2			103.0			100.9			85.5		
Machine Index, %				100.2			101.8			97.8			85.0		

TABLE XIII

SUMMARY OF TEST RESULTS FOR MACHINE K
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
K-1	12- 6-58	12-29-58	1	27.1	13.3	11.2	11.9	38.4	36.0	37.3	29.8	27.2	28.2	1000	1
K-2	12- 6-58	12-29-58	3	27.9	10.0	8.5	9.1	39.0	32.4	35.5	34.2	32.2	32.9	1000	1-1/2
Current Machine Average				27.5			10.5			36.4			30.6		
Cumulative Machine Average				27.5			10.1			39.4			30.2		
Machine Factor, %				100.0			103.6			92.4			101.1		
Machine Index, %				101.4			102.3			102.9			91.0		

TABLE XIV

SUMMARY OF TEST RESULTS FOR MACHINE L
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
L-1	12-22-58	1-15-59	29	26.8	11.0	10.1	10.5	38.4	34.8	36.8	36.8	33.6	34.6	800	1/2
L-2	1-13-59	1-15-59	30	26.7	12.0	10.6	11.3	34.2	32.4	33.2	35.2	31.8	32.9	750	Min.
Current Machine Average				26.8			10.9			35.0			33.8		
Cumulative Machine Average				26.5			10.4			35.8			34.6		
Machine Factor, %				101.2			104.7			98.0			97.7		
Machine Index, %				98.8			106.1			99.0			100.5		

TABLE XV

SUMMARY OF TEST RESULTS FOR MACHINE M
January, 1959

M-1	12-18-58	1- 6-59	233	28.0	10.2	9.7	9.9	40.2	36.0	37.3	34.8	32.6	33.9	850	1
M- 2	12-19-58	1- 6-59	234	27.9	9.9	9.1	9.5	40.8	33.0	37.7	34.8	31.0	32.4	1000	1-1/2
M-3	12-22-58	1- 6-59	235	27.1	10.1	9.2	9.7	41.4	38.4	40.3	36.0	33.6	34.7	1000	1-1/2
M-4	12-23-58	1- 6-59	236	27.1	10.0	9.2	9.5	41.4	32.4	38.6	35.0	33.0	34.1	1000	1-1/2
M-5	1- 8-59	1-19-59	237	26.7	9.2	8.8	9.0	42.6	36.6	39.6	35.2	32.8	33.5	900	1
M-6	1-10-59	1-19-59	238	27.4	10.0	9.6	9.8	39.6	37.8	38.8	34.4	32.2	33.2	1000	1-1/2
M-7	1-10-59	1-19-59	239	27.8	10.0	9.2	9.7	38.4	36.6	37.6	35.4	33.0	34.4	800	1
Current Machine Average				27.4			9.6			38.6			33.7		
Cumulative Machine Average				27.0			9.3			36.7			34.3		
Machine Factor, %				101.3			103.2			105.1			98.5		
Machine Index, %				101.1			93.3			109.0			100.4		

TABLE XVI

SUMMARY OF TEST RESULTS FOR MACHINE N
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m., lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
N-1	12-19-58	12-29-58	431	27.2	11.2	10.3	10.9	40.8	34.2	38.8	35.8	33.4	34.7	900	1
N-2	1- 1-59	1- 7-59	432	26.7	12.0	10.3	11.2	44.4	40.2	42.0	39.0	37.0	38.2	900	1/2
N-3	1- 2-59	1- 9-59	433	26.8	12.1	10.6	11.4	46.2	39.0	42.4	38.4	36.6	37.5	1000	1-1/2
N-4	1- 6-59	1- 9-59	434	26.3	11.0	10.0	10.4	43.2	35.4	39.8	35.6	32.6	33.8	1000	1-1/2
N-5	1- 9-59	1-12-59	435	26.8	11.3	10.3	10.9	43.2	38.4	40.3	35.4	34.0	34.8	1000	1-1/2
N-6	1-13-59	1-19-59	436	26.7	11.3	10.8	11.0	41.4	36.0	38.6	36.0	33.0	34.8	1000	1-1/2
N-7	1-16-59	1-21-59	437	26.2	11.4	10.2	10.8	41.4	36.6	39.6	34.0	32.4	33.4	900	1-1/2
Current Machine Average				26.7			11.0			40.2			35.3		
Cumulative Machine Average				26.6			10.8			39.8			37.7		
Machine Factor, %				100.4			101.3			101.0			93.6		
Machine Index, %				98.4			106.7			113.7			105.2		

TABLE XVII

SUMMARY OF TEST RESULTS FOR MACHINE O
January, 1959

O-1	12-30-58	1-12-59	159	28.4	10.0	9.5	9.8	40.8	36.0	38.5	31.4	29.2	30.6	200	—
O-2	1- 6-59	1-21-59	160	28.7	10.6	9.9	10.2	45.0	36.6	39.8	Note a			Note a	
Current Machine Average				28.5			10.0			39.2			30.6		
Cumulative Machine Average				28.8			9.9			37.4			35.1		
Machine Factor, %				98.9			101.4			104.7			87.1		
Machine Index, %				105.3			97.7			110.7			91.0		

Note a: Single-face flat crush could not be determined because the medium fractured even at a speed of 100 f.p.m.

TABLE XVIII

SUMMARY OF TEST RESULTS FOR MACHINE P
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m. lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
P-1	12-10-58	12-29-58	274	28.0	10.7	10.0	10.4	40.8	38.4	39.6	37.0	33.2	35.1	800	1-1/2
P-2	12-17-58	12-29-58	275	28.7	11.0	10.4	10.7	43.2	37.2	40.4	37.0	35.4	36.1	1000	1-1/2
P-3	12-18-58	12-29-58	276	27.6	10.6	10.0	10.2	45.0	39.6	41.6	36.4	34.4	35.8	1000	1-1/2
P-4	12-30-58	1-12-59	277	28.5	10.7	10.1	10.3	45.6	40.8	42.5	37.6	34.8	36.3	1000	1-1/2
P-5	1- 1-59	1- 8-59	278	28.3	11.2	10.3	10.8	45.0	40.8	42.4	37.0	35.0	36.0	1000	1-1/2
P-6	1- 6-59	1-16-59	279	28.3	10.8	10.2	10.6	46.8	41.4	43.7	41.2	39.0	40.4	850	1/2
P-7	1- 9-59	1- 19-59	280	27.1	10.7	9.8	10.3	42.0	38.4	40.3	34.2	33.4	33.6	1000	1-1/2
P-8	1-14-59	1- 21-59	281	27.0	11.2	10.0	10.5	43.8	39.0	41.9	36.6	34.8	35.9	900	1/2
Current Machine Average				27.9			10.5			41.6			36.2		
Cumulative Machine Average				27.2			10.2			38.1			36.2		
Machine Factor, %				102.7			102.3			108.9			100.0		
Machine Index, %				103.1			102.0			117.4			107.8		

TABLE XIX

SUMMARY OF TEST RESULTS FOR MACHINE Q
January, 1959

Code	Date Made	Date Recd.	Mill Roll No.	Basis Weight, lb. per 1000 sq. ft.	Caliper, points			Concora Flat Crush, p.s.i.			Single-Face Flat Crush, p.s.i.			Runability: Max. Speed at Min. Tension, f.p.m.	Runability: Max. Tension at 600 f.p.m. lb./in.
					Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.		
Q-1	1-14-59	1-23-59	214	27.6	10.8	10.3	10.6	38.4	34.2	35.3	32.4	29.8	31.1	1000	1-1/2
Q-2	1-15-59	1-23-59	215	28.0	10.9	10.0	10.5	37.8	36.0	36.5	35.6	32.0	32.7	1000	1-1/2
Current Machine Average				27.8			10.6			35.9			31.9		
Cumulative Machine Average				28.3			10.5			34.3			32.1		
Machine Factor, %				98.3			100.1			104.7			99.3		
Machine Index, %				102.7			102.7			101.4			95.1		

TABLE XX

SUMMARY OF TEST RESULTS FOR MACHINE R
January, 1959

R-1	12-27-58	1- 7-59	107	28.5	11.4	10.6	11.0	36.6	33.6	34.8	32.2	30.0	31.0	1000	1-1/2
R-2	12-27-58	1- 7-59	108	28.8	11.3	10.3	10.9	37.2	33.6	34.9	30.0	29.4	29.6	1000	1-1/2
R-3	1-14-59	1-23-59	113	27.5	11.3	10.8	11.1	34.8	30.0	32.6	29.4	28.4	29.1	1000	1-1/2
R-4	1-14-59	1-23-59	114	27.5	11.3	10.9	11.1	36.6	31.8	34.3	31.4	28.8	29.9	1000	1-1/2
Current Machine Average				28.1			11.0			34.2			29.9		
Cumulative Machine Average				27.6			10.4			33.3			32.0		
Machine Factor, %				101.8			105.6			102.7			93.4		
Machine Index, %				103.6			107.0			96.6			89.0		

DISCUSSION OF CONCORA FLAT CRUSH TEST RESULTS OBTAINED AT THE INSTITUTE OF PAPER CHEMISTRY AND THOSE OBTAINED AT THE MILLS

In Table XXI a comparison of I.P.C. and mill Concora flat crush test results is given for the month of January. These comparisons were initiated in Progress Report 30 and permit interested participants to submit their Concora flat crush test results to The Institute of Paper Chemistry so that comparative results may be included in the monthly reports. Data sheets for supplying this information may be obtained from the Institute. Comparisons of this kind are a helpful adjunct to other calibration procedures. It may be noted in Table XXI that fifteen of the eighteen participating machines are included in this comparison of Concora flat crush data. Shown in Table XXI are the I.P.C. and mill Concora averages for each roll included in this comparison. In a few cases mill averages were not submitted for all rolls. In these instances, the current machine average based on I.P.C. data included only those rolls for which mill data were received. The average difference between the current machine average based on I.P.C. data and that based on mill data is shown in Table XXI for each machine. For each roll the difference between the average Concora result based on I.P.C. data and that based on mill data is also shown. The plus or minus sign denotes whether the mill average was higher or lower than the I.P.C. average.

TABLE XXI

COMPARISON OF INSTITUTE AND MILL CONCORA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR JANUARY, 1959

Machine A						Machine B						Machine C					
			Concora Flat Crush, p.s.i.						Concora Flat Crush, p.s.i.						Concora Flat Crush, p.s.i.		
Code	Mill Roll No.	Date Made	Institute	Mill	Difference [a]	Code	Mill Roll No.	Date Made	Institute	Mill	Difference [a]	Code	Mill Roll No.	Date Made	Institute	Mill	Difference [a]
A-1	479	12- 6-58	37.9	35.6	-2.3	B-1	111	1- 8-59	34.8	38.6	+3.8	C-1	494	12- 6-58	37.3	36.6	-0.7
A-2	698	12- 8-58	36.2	39.8	+3.6	B-2	112	1- 8-59	32.4	35.4	+3.0	C-2	751	12- 9-58	39.7	41.0	+1.3
A-3	1213	12-17-58	37.3	37.4	+0.1							C-3	1249	12-15-58	34.8	34.6	-0.2
A-4	1320	12-18-58	36.4	37.0	+0.6							C-4	1637	12-20-58	36.4	35.5	-0.9
A-5	1616	12-22-58	34.8	39.4	+4.6							C-5	2014	12-30-58	37.6	41.1	+3.5
A-6	67	1- 1-59	36.2	39.7	+3.5							C-6	2102	12-31-58	39.6	42.4	+2.8
Current Machine Av.			36.5	38.2	+1.7	Current Machine Av.			33.6	37.0	+3.4	Current Machine Av.			37.6	38.5	+0.9
Machine D						Machine F						Machine G					
D-1	184	12- 9-58	36.6	41.2	+4.6	F-1	29	12-23-58	34.4	42.7	+8.3	G-1	136	1- 3-59	37.6	35.8	-1.8
						F-2	30	1- 5-59	35.0	42.1	+7.1	G-2	137	1- 8-59	36.6	37.8	+1.2
												G-3	138	1- 8-59	39.0	37.2	-1.8
Current Machine Av.			36.6	41.2	+4.6	Current Machine Av.			34.7	42.4	+7.7	Current Machine Av.			37.7	36.9	-0.8
Machine H						Machine I						Machine J					
H-1	79	12-20-58	36.2	35.6	-0.6	I-1	195	11- 6-58	34.8	—	--	J-1	109	12-31-58	33.8	36.2	+2.4
H-2	80	12-20-58	37.8	38.3	+0.5	I-2	197	11-13-58	35.8	—	--	J-2	110	12-31-58	35.4	35.4	0.0
H-3	81	12-30-58	34.2	36.4	+2.2	I-3	199	11-20-58	31.1	32.9	+1.8						
H-4	82	12-30-58	35.6	35.5	-0.1	I-4	202	11-28-58	37.1	35.4	-1.7						
						I-5	203	12- 3-58	34.4	31.9	-2.5						
						I-6	205	12-19-58	38.6	—	--						
						I-7	206	12-23-58	32.2	34.2	+2.0						
						I-8	207	12-30-58	34.3	34.8	+0.5						
						I-9	209	1-13-59	37.3	36.0	-1.3						
Current Machine Av.			36.0	36.4	+0.4	Current Machine Av.			34.4	34.2	-0.2	Current Machine Av.			34.6	35.8	+1.2

[a] The difference given here is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

TABLE XXI—Continued

COMPARISON OF INSTITUTE AND MILL CONCORA FLAT CRUSH TEST RESULTS ON INDIVIDUAL ROLLS FOR JANUARY, 1959

Machine L						Machine M						Machine N					
	Mill		Concora Flat Crush, p.s.i.				Mill		Concora Flat Crush, p.s.i.				Mill		Concora Flat Crush, p.s.i.		
Code	Roll No.	Date Made	Institute	Mill	Difference [a]	Code	Roll No.	Date Made	Institute	Mill	Difference [a]	Code	Roll No.	Date Made	Institute	Mill	Difference [a]
L-1	29	12-22-58	36.8	46.0	+9.2	M-1	233	12-18-58	37.3	--	--	N-1	431	12-19-58	38.8	39.0	+0.2
L-2	30	1-13-59	33.2	40.4	+7.2	M-2	234	12-19-58	37.7	--	--	N-2	432	1- 1-59	42.0	46.9	+4.9
						M-3	235	12-22-58	40.3	--	--	N-3	433	1- 2-59	42.4	45.7	+3.3
						M-4	236	12-23-58	38.6	--	--	N-4	434	1- 6-59	39.8	41.5	+1.7
						M-5	237	1- 8-59	39.6	39.4	-0.2	N-5	435	1- 9-59	40.3	40.9	+0.6
						M-6	238	1-10-59	38.8	38.8	0.0	N-6	436	1-13-59	38.6	39.0	+0.4
						M-7	239	1-10-59	37.6	37.2	-0.4	N-7	437	1-16-59	39.6	38.8	-0.8
Current Machine Av.			35.0	43.2	+8.2	Current Machine Av.			38.7	38.5	-0.2	Current Machine Av.			40.2	41.7	+1.5
Machine O						Machine P						Machine R					
O-1	159	12-30-58	38.5	36.4	-2.1	P-1	274	12-10-58	39.6	41.3	+1.7	R-1	107	12-27-58	34.8	32.4	-2.4
O-2	160	1- 6-59	39.8	33.6	-6.2	P-2	275	12-17-58	40.4	44.5	+4.1	R-2	108	12-27-58	34.9	32.4	-2.5
						P-3	276	12-18-58	41.6	40.0	-1.6	R-3	113	1-14-59	32.6	32.5	-0.1
						P-4	277	12-30-58	42.5	39.2	-3.3	R-4	114	1-14-59	34.3	32.5	-1.8
						P-5	278	1- 1-59	42.4	40.7	-1.7						
						P-6	279	1- 6-59	43.7	41.4	-2.3						
						P-7	280	1- 9-59	40.3	38.3	-2.0						
						P-8	281	1-14-59	41.9	39.5	-2.4						
Current Machine Av.			39.2	35.0	-4.2	Current Machine Av.			41.6	40.6	-1.0	Current Machine Av.			34.2	32.4	-1.8

[a] The difference given here is the amount in p.s.i. units by which the mill result is higher or lower than the Institute result.

The data shown in Table XXI are summarized in Part I of Table XXII where for each machine the following information is given: (1) Current machine average based on I.P.C. data, (2) current machine average based on mill data, (3) the average difference--that is, the difference between the current machine average based on I.P.C. data and that based on mill data and (4) the maximum difference encountered in comparing I.P.C. and mill test averages for individual rolls. In Part II of Table XXII the average difference of Part I has been converted to per cent by dividing it by the I.P.C. average and multiplying the result by 100. The average differences in per cent for the current report and the two preceding reports are shown. It may be seen that the highest average difference of 23.4% was associated with Machine L for the current period and the lowest of 0.5% with Machine M. Differences greater than ten per cent were noted for Machines B, D, F, L, and O. Of these machines it may be noted that Machines F and L have been associated with large differences not only for the current report but also for the two preceding reports, and the differences may be accounted for in part by the fact that the results were obtained on specimens which had not been conditioned after they were fluted. The differences for Machines B, D, and O, however, may not be accounted for in this way.

TABLE XXII

PART I: A COMPARATIVE SUMMARY FOR EACH MACHINE OF THE CONCORA FLAT CRUSH AVERAGES BASED ON I.P.C. DATA AND THOSE BASED ON MILL DATA

Machine Code	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
No. of Rolls Compared	6	2	6	1	0	2	3	4	6	2	0	2	3	7	2	8	0	4
Concora Flat Crush, p.s.i.																		
Current Machine Av. (I.P.C.)[a]	36.5	33.6	37.6	36.6		34.7	37.7	36.0	34.4	34.6		35.0	38.7	40.2	39.2	41.6		34.2
Current Machine Av. (Mill) [a]	38.2	37.0	38.5	41.2		42.4	36.9	36.4	34.2	35.8		43.2	38.5	41.7	35.0	40.6		32.4
Average Difference [b]	+1.7	+3.4	+0.9	+4.6		+7.7	-0.8	+0.4	-0.2	+1.2		+8.2	-0.2	+1.5	-4.2	-1.0		-1.8
Maximum Difference [c]	+4.6	+3.8	+3.5	+4.6		+8.3	-1.8	+2.2	-2.5	+2.4		+9.2	-0.4	+4.9	-6.2	+4.1		-2.5

PART II. A TABULATION FOR EACH MACHINE OF THE AVERAGE DIFFERENCE (PER CENT) BETWEEN THE CONCORA FLAT CRUSH AVERAGE BASED ON I.P.C. DATA AND THAT BASED ON MILL DATA

Average Difference, % [d]																		
Current report	+4.7	+10.1	+2.4	+12.6	--	+22.2[e]	-2.1	+1.1	-0.6	+3.5	--	+23.4[e]	-0.5	+3.7	-10.7	-2.4	--	-5.3
38th report	-1.4	+5.8	+3.9	-15.1	--	+16.6[e]	+0.3	--	--	-8.4	--	+30.3[e]	+2.9	+5.1	-10.9	-0.2	--	+0.6
37th report	+2.0	+5.9	+5.1	-12.6	+18.5	+17.1[e]	-1.9	+1.6	+6.7	+14.2	--	+17.3[e]	+1.0	-1.0	-3.2	-3.6	--	+4.4

[a] Comparisons based on current machine averages include only those rolls for which mill data were submitted.

[b] Average difference is the difference between the current machine average based on I.P.C. test results and that based on mill test results with the I.P.C. test results used as the reference. See Table XXI.

[c] Maximum difference is the greatest difference encountered in comparing I.P.C. and mill test averages for individual rolls. See Table XXI.

[d] Average difference (per cent) is computed by dividing the average difference in p.s.i. (shown above in Part I of this table) by the I.P.C. current machine average and multiplying the result by 100 to obtain the average difference in per cent.

[e] Concora specimens evaluated by this mill were not conditioned.

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